Example of CO Credit Calculations

1. Based on available emission test data the changes in percent in CO emission per weight percent increase in oxygen content are presented in Table 1.

Table 1. Summary of CO reduction associated with increased oxygen.

Study	Older Vehicles	Current Vehicles 86 to 89 MY	Current Vehicles 91 to 95 MY	Federal Tier 1	Advance Tech.
Auto/Oil Bulletin #1	-4.5%	-5.2%	N/A	N/A	N/A
Auto/Oil Bulletin #4	-5.6%	N/A	N/A	N/A	N/A
Auto/Oil Bulletin #6	N/A	-4.3%	N/A	N/A	N/A
Auto/Oil Bulletin #17	N/A	-4.75%	N/A	-0.56%	0.49%
ARB EtOH	N/A	N/A	-1.35%	N/A	N/A
Average	-5.07%	-4.76%	-1.35%	0.00%	0.00%

The reductions for Federal Tier 1 and Advanced Vehicles are sufficiently small that they will be assumed to be zero. (In its draft document, Fuel Oxygen Effects on Exhaust CO Emissions, Recommendations for MOBILE6, March 16, 1998, the U. S. EPA also assumed that the effects of oxygen addition to be zero on CO emissions from these vehicles.)

2. EMFAC 7G was used to determine a baseline for CO emissions from the different groups of vehicles for the year 2005. This information is presented in both Table 2 and Table 3.

3. This analysis is to estimate the possible impact of increasing fuel oxygen content from 2.0 weight percent to 3.5 weight percent. Since Table 1 presents the percent decrease in CO associated with a 1% increase in oxygen the change in oxygen content is multiplied by 1.5.

4. Federal Tier 1 and Advanced Technology vehicles are combined and represented as '96 to 05 MY'.

5. It has been suggested that we include effects of oxygen on off cycle emissions. Based on data from the ARB Ethanol study, it is estimated that the amount of emission reductions calculated using FTP and REPO5 test data is 2.8 time that of those calculated using FTP composite test data. Given the lack of any other directly relevant information, this analysis will include percent changes in CO emissions determined by using FTP composite test data and those determined by using the combination of FTP and REPO5 emissions test data.

6. The expected changes in CO emission from increasing the oxygen content from 2.0 weight percent to 3.5 weight percent are given in Table 2 and Table 3.

TABLE 2. CO Reductions Based on FTP Composite Emissions

	81-85 MY	86 to 90 MY	91 to 95 MY	96 to 05 MY	Total
CO Emissions, TPD	712.00	1171.00	1041.00	2071.00	4995.00
Total Evaporative HC Emissions, TPD	22.48	43.67	69.67	59.23	195.05
% CO Reduction per wt. % Oxygen	-5.07%	-4.76%	-1.35%	0.00%	
WT. % Oxygen Increased (2 to 3.5)	1.50	1.50	1.50	1.50	
Adjusted CO Reductions	-54.15	-83.58	-21.08	0.00	-158.81

TABLE 3: CO Reductions Base on FTP and REPO5 Emissions.

	81-85 MY	86 to 90 MY	91 to 95 MY	96 to 05 MY	Total
CO Emissions, TPD	712.00	1171.00	1041.00	2071.00	4995.00
Total Evaporative HC Emissions, TPD	22.48	43.67	69.67	59.23	195.05
% CO Reduction per wt. % Oxygen	-5.07%	-4.76%	-1.35%	0.00%	
WT. % Oxygen Increased (2 to 3.5)	1.50	1.50	1.50	1.50	
Weighted / FTP COMP	2.8	2.8	2.8	2.8	
Adjusted CO Reductions	-151.61	-234.02	-59.02	0.00	-444.66

7. From TABLE 2, the total reduction in CO emissions are estimated to be about 159 tons per day based on FTP composite emissions data. The MIR factor for CO is 0.07 grams of ozone per grams of CO; therefore the reduction in ozone that could be expected is about 11.1 tons per day. The average MIR factor for evaporative emissions has been calculated to be 2.2, therefore the ozone expected from evaporative emission is 429 tons.

8. From TABLE 3, the total reductions in CO emissions are estimated to be about 445 tons per day based on the composite FTP and REPO5 data. The MIR factor for CO is 0.07 grams of ozone per grams of CO; therefore the reduction in ozone that could be expected is about 31.2 tons per day. The average MIR factor for evaporative emissions has been calculated to be 2.2, therefore the ozone expected from evaporative emission is 429 tons.